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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION OF:	DONG ET AL.	EXAMINER:	MISLEH, JUSTIN
APPLICATION NO.:	09/399,510	ART UNIT:	2612
FILED:	SEPTEMBER 20, 1999	CONF. NO:	2349

FOR: **AUTO BLACK EXPANSION METHOD AND APPARATUS FOR AN IMAGE SENSOR**

Appellant's Brief Under 37 C.F.R. § 1.192

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I. REAL PARTY IN INTEREST

The real party in interest in the above-identified application is OmniVision Technologies, Inc., a corporation formed under the laws of the state of Delaware and having a current business address of 1341 Orleans Drive, Sunnyvale, California 94089. OmniVision Technologies is the owner of all right, title, and interest in the above-identified application.

II. RELATED APPEALS AND INTERFERENCES

Applicant, applicant's legal representative, and the real party in interest are unaware of any appeal or interference that will directly affect, be directly affected by, or have a bearing on the Board's decision in the present appeal.

III. STATUS OF CLAIMS

Claims 1-3, 6-7, and 10 are pending and currently stand rejected by the Examiner under the final rejection mailed May 19, 2004. Claims 1-2, 6-7, and 10 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,597,395 to Kim et al. Claim 3 stands rejected as being obvious in view of the Kim patent. In a

Notice of Appeal dated August 4, 2004, appellant appealed from the final decision of the Examiner. The final rejections of Claims 1-3, 6-7, and 10 therefore stand appealed.

IV. STATUS OF AMENDMENTS

There are no amendments pending that have not been entered. A copy of all claims on appeal is provided in Appendix A.

V. SUMMARY OF INVENTION

The present invention relates to image sensors, such as those commonly used in digital cameras, cell phones, security systems, and the like. Image sensors generally include circuitry for the performing of black level calibration. Black level calibration attempts to eliminate the portion of the image signal that exists when no light is being detected, thus allowing for a true zero reference signal so that later signal processing is improved. Moreover, image sensors also typically include automatic gain control circuitry. Automatic gain control circuitry amplifies the video signal at a controlled level so as to utilize more of the available signal amplification range. This allows the image sensor to operate in a variety of light environments, ranging from very dark low light conditions to bright outside sunlight.

The present invention is a simplified digital control system for controlling both the auto black expansion and automatic gain control of an image sensor. The control system is based on a count of the number of pixels of the image sensor with a signal intensity that occurs below selected levels. The number of pixels that are below a first voltage level is used to adjust the black level calibration. All the pixels are also compared to a second different voltage level and a count is maintained for the number of pixels underneath the second voltage level. The number of pixels underneath the second voltage level is then used to adjust the amplification of the image sensor. This simple and elegant method for controlling black level calibration and automatic gain control by the use of comparisons to two different voltage levels provides computational and circuitry simplicity to the image sensor.

A schematic diagram can be seen in Figure 3 of the present application. A comparator 406 compares the pixel signals to a reference voltage V_{Blk}. A counter 412 is

used to count the number of pixels that fall underneath this black calibration threshold. A digital controller 410 is then used to control the automatic black expansion unit 402 using the results from the counter 412. A similar process is used with respect to the automatic gain control block 404. This is controlled by a signal 424 from the digital control 410. The digital control 410 receives as its control signal the number of pixels that fall underneath the second voltage threshold V_{bar}. Further, as seen in Figure 5C, based upon the counter totals at counters 412 and 414, the auto black expansion unit 402 and the automatic gain control unit 404 are either increased or decreased based upon the count from the respective counters.

VI. ISSUE PRESENTED FOR REVIEW

The sole issue presented for review is whether the Examiner improperly rejected Claims 1-2, 6-7, and 10 under 35 U.S.C. § 102(e) as being anticipated by Kim. Applicant concedes that if the Board finds that Kim anticipates the independent Claim 1, then Claim 3 would be obvious in view thereof.

VII. GROUPING OF CLAIMS

For purposes of this appeal, Claims 1-3, 6-7, and 10 all stand together.

VIII. ARGUMENTS

A. The Examiner's Rejections

In the final Office Action, the pending claims were rejected under 35 U.S.C. § 102 as being anticipated by Kim.

B. Summary of the Cited Prior Art

1. Kim Only Discloses a Method of Automatic Black Level Calibration Using Frame Level Analysis, Not Pixel Level Analysis

The Kim patent describes a black level calibration mechanism for a video camera. The black level calibration apparatus of Kim generates a black level clamp signal based on a calibrated reference voltage. See Abstract. Further, the same black level clamp signal is used to control automatic gain control operations. See Abstract.

As detailed in the Kim patent, a digital comparator 230 compares the black level value A of the digital image signal with a previously set black level calibration value B received from a microcomputer. See Col. 3, lines 57-60. Thus, **the entire digital image is compared to a reference black level calibration value. There is no indication that the individual pixels of the image are compared**. Further, an up/down counter 240 raises or lowers a count value depending upon the output signal from the comparator 230. Col. 3, lines 65-67. Because the comparison made by comparator 230 is on the entire digital image signal, the counter 240 can either increase or decrease only by a single increment for each frame of the video camera. While the Kim patent does show a circuit for automatic gain control 200, there is no indication in Kim as to how the automatic gain control is varied. In contrast, only the black level calibration value is varied.

C. No Anticipation Under 35 U.S.C. § 102

In order for the Examiner to properly reject the claims as being anticipated under 35 U.S.C. § 102, the Examiner has to show that each and every claim limitation of the independent claims are shown by the Kim reference. The Examiner cannot satisfy this burden.

Specifically, as indicated above, the Kim patent **does not teach the comparison of an individual pixel of an image to a threshold level**. In contrast, the Kim patent compares **an entire digital image to a voltage reference**. This level of analysis provides relatively slow adjustments to light conditions. In contrast, the claimed invention, requires that the comparisons to a threshold voltage is made at the pixel level. Thus, Claim 1 recites the step of "comparing the voltage level of **processed pixel signals** with a first set voltage level". Similar language is set forth in Claim 7. The Kim patent is completely silent as to the comparison of a pixel to a voltage level. The only comparison taught by Kim is the comparison of a digital image signal to a reference level. Thus, while Kim looks at the signal level of an image frame **as a whole** to a reference level, the present claimed invention compares each pixel of an image frame to a voltage level. For this reason, the Examiner's rejection of the claims is inappropriate.

Further, there are yet other significant differences between the methodology of the Kim patent and the present claimed invention. While applicants agree that the Kim patent also provides a method for black level calibration, the methodology used in the Kim patent is significantly different than the claimed invention.

Claims 1 and 7 require the use of **a second counter** to determine the automatic gain control and amplification system. This is not fairly shown in the Kim patent. While the Kim patent discloses an automatic gain control block 200, there is no indication that the automatic gain control block 200 can be adjusted in any manner, let alone be adjusted based upon the use of a second counter as is required in Claims 1 and 7.

The first set voltage level as used in the claimed invention is used for modifying the black calibration level while the second (different) set voltage level is used for modifying the automatic gain control system. The Kim patent does not address the modification of the automatic gain control using a comparison to a second set voltage level independent and not based on the first set voltage level.

The Examiner argues that the Kim patent teaches the use of a second voltage level and a second counter. The Examiner argues that the pixels in Kim are compared to the second voltage level, which is the "divided voltage value" as shown in Figure 3. The reference to divided voltage value in Kim is further detailed in Figure 3 and Col. 4, lines 14-62. The discussion therein relates to a digital to analog converter 250 that includes a decoder 251. The D/A converter 250 also includes a voltage divider 252 that is the operative circuit that performs the conversion of a digital word (2^n) to an analog voltage.

The Examiner's arguments that a "divided voltage value" is a second voltage level is erroneous. The divided voltage value is simply the analog version of the digital signal input into the D/A converter 250. They are not two different unrelated voltage levels as required by the claims, **but rather different versions of the same voltage level and related to each other.**

Additionally, the Examiner argues that counter 240 maintains two counts: the pixels compared against a first voltage level (for black level calibration) and the pixels

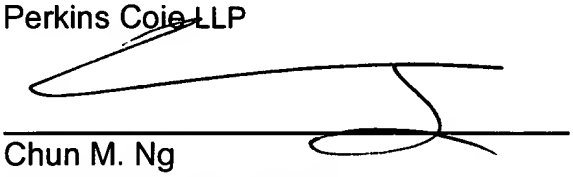
compared against a second voltage level (for automatic gain purposes). This is also erroneous. As noted above, the n-bit control word is the digital version of the analog voltage output by the D/A converter 250. For the Examiner to argue that Kim teaches two voltage levels and two counters is inappropriate and contrary to a plain reading of the Kim patent.

The Examiner argues that the second count is used to control automatic gain control. However, at Col. 5, lines 5-15, the black level clamp circuit 260 only clamps the black level of the CDS/AGC circuit 200. Thus, the black level claim circuit 260, while providing feedback to the CDS/AGS circuit 200, does not vary the automatic gain control of the CDS/AGC circuit 200.

IX. CONCLUSION

Claims 1-3, 6-7, and 10 have been improperly rejected because the Examiner has failed to establish that Kim fairly shows each and every element of the independent claims. Accordingly, Appellant respectfully requests that the Board reverse the Examiner's rejection of these claims and return the application to the Examiner with instructions to allow pending Claims 1-3, 6-7, and 10.

Respectfully submitted,
Perkins Coie LLP



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APPENDIX A

Following is a list of the claims involved in this appeal, as amended:

1. A method for auto black expansion in an image sensor, comprising:
   (a) comparing the voltage level of processed pixel signals with a first set voltage level;
   (b) maintaining a first count of a number of pixel signals that are above or below the first set voltage level;
   (c) using the count to determine a first digital control signal for adjusting the black level calibration of the processed pixel signals; and
   (d) comparing the pixel signals to a second set voltage level different from said first set voltage level and maintaining a second count related to the comparison of the pixel signals to the second level, wherein the second count is used to determine a second digital control signal for adjusting the amplification of the processed pixel signals.

2. The method of Claim 1, wherein the adjustments to the black level calibration are made in between fields of pixel signals.

3. The method of Claim 1, wherein the digital control signal comprises 8-bits.

6. The method of Claim 5, wherein adjustments to the amplification of the processed pixel signals are only made after adjustments to the black level calibration have adjusted the pixel signals to a desired voltage level.

7. An image sensor for processing image signals that are comprised of processed pixel signals, the image sensor comprising:
   (a) auto black expansion circuitry for adjusting the relative voltage level of the image signal;
   (b) a black level voltage input;
   (c) a comparator, the comparator comparing the processed pixel signals to a desired black level signal;

(d) a counter for maintaining a count related to the comparison performed by the comparator;

(e) a digital controller for utilizing the count maintained by the counter to determine desired adjustments to the auto black expansion circuitry; and

(f) a mid-level voltage input different from said black level voltage input, and a second comparator for comparing the processed pixel signals to the mid-level voltage input; and

(g) automatic gain control circuitry, wherein the digital controller utilizes the count of a second counter to determine adjustments to the automatic gain control circuitry.

10. The image sensor of Claim 7, wherein the adjustments to the auto black expansion circuitry are made in between fields of pixel signals.